Claims

What is claimed:

1. A method for executing a combinatorial auction, the method comprising the steps of:

    (1) reading input data comprising:

        (i) items;

        (ii) players bidding on the items;

and

        (iii)   bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid;

    (2) generating proposals by utilizing the input data, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction;

    (3) selecting a set of proposals such that each item is included in at most one selected proposal;

and

    (4) informing the players bidding on the items of the results in step (3).

2. A method according to claim 1, wherein step (1) comprises reading input data further including at least one type that is specified for each bid, and wherein step (2) proposals are limited to collections of bids from a player that are of the same type, and wherein step (3) the set of selected proposals is limited to sets that include at most one proposal for each player.

3. A method according to claim 1 wherein step (2) comprises generating all possible proposals.

4. A method according to claim 1, comprising enabling step (3) by using an integer programming technique.

5. A method according to claim 1, wherein step (3) comprises selecting a set of proposals that maximizes the total value of the bids included in the selected proposals.

6. A method for selecting a set of bids in a combinatorial auction for at least two items involving at least one player and at least one type of bid for each player such that:

   (a) each item is contained in at most one (or exactly one) selected bid;

   (b) for each player, the selected bids all belong to the same type;

and among all collections of bids satisfying (a) and (b) the selected bids maximizes total revenue, said method comprising the steps of:

   (1) generating all valid proposals;

   (2) formulating an integer program that includes a column for each proposal, a constraint for each item and a constraint for each player, said constraints representing conditions (a) and (b) respectively, and an objective function which represents revenue;

   (3) solving the integer program for selecting the set of proposals that maximizes revenue; and

   (4) constructing a set of winning bids from the set of winning proposals.

7. A method according to claim 6, comprising an additional step of checking for ties by adding a constraint.

8. A method for selecting a set of bids in a combinatorial auction for at least two items involving at least one player and at least one type of bid for each player such that:

(a) each item is contained in at most one (or exactly one) selected bid;

(b) for each player, the selected bids all belong to the same type;

and among all collections of bids satisfying (a) and (b) the selected bids maximizes total revenue, said method comprising the steps of:

(1) generating a set of valid proposals;

(2) formulating an integer program that includes a column for each proposal, a constraint for each item and a constraint for each player, said constraints representing conditions (a) and (b) respectively, and an objective function which represents revenue;

(3) solving a linear programming relaxation of the integer program in (2) for obtaining dual variables associated with each of the constraints;

(4) using dual variables obtained in (3) for determining the excess value associated with each bid, and a threshold for each player;

(5) using a proposal generation method for selecting each player and type, a proposal for which the excess value exceeds the threshold, or determining that no such proposal exists;

(6) adding the proposals generated in (5) and repeating steps (3), (4) and (5) until no new proposals are identified;

(7) solving the integer program that includes all identified proposals;

and

(8) constructing a set of winning bids from the set of winning proposals.

9. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for executing a combinatorial auction, said methods steps comprising:

    (1) reading input data comprising:

        (i) items;

        (ii) players bidding on the items;

and

        (iii)   bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid;

    (2) generating proposals by utilizing the input data, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction;

    (3) selecting a set of proposals such that each item is included in at most one selected proposal;

and

    (4) informing the players bidding on the items of the results in step (3).

10. A computer comprising:

    (1) means for reading input data comprising:

        (i) items;

        (ii) players bidding on the items;

and

(iii)   bids, where each bid specifies the player bidding, the amount bid, and the

list of items included in the bid;

(2) means for generating proposals by utilizing the input data, each said proposal

comprising a collection of bids that can be awarded to a player participating in the auction;

(3) means for selecting a set of proposals such that each item is included in at most one

selected proposal;

and

(4) means for informing the players bidding on the items of the results in element (3).